UNITED STATES PATENT APPLICATION

FOR

COKE DRUM OUTLET OVERHEAD DEFLECTOR PLATE APPARATUS AND METHOD

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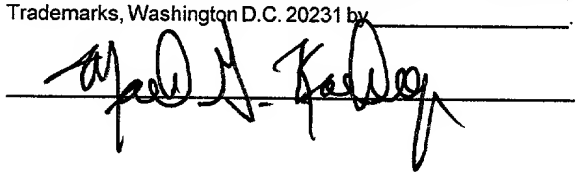

COKE DRUM OUTLET OVERHEAD DEFLECTOR PLATE APPARATUS AND METHOD

CROSS-REFERENCE OF RELATED APPLICATION

This application claims priority to U.S. Provisional Application No. 60/211,438, filed June 13, 2000.

COKE DRUM OUTLET OVERHEAD DEFLECTOR PLATE APPARATUS AND METHOD

BACKGROUND OF THE INVENTION

1. Field of the Invention.

The present invention relates to delayed coking. More particularly, the present invention relates to a deflector placed inside the top of a coke drum and below the overhead vapor outlet nozzle to reduce the amount of solids and heavy hydrocarbon liquids from escaping through the outlet nozzle of the coke drum and returning back to the fractionator.

2. Description of the Prior Art.

During operation of delayed coking drums for the coking of various heavy hydrocarbon materials in petroleum refining operations, heavy hydrocarbons are thermally decomposed to produce gases, liquid and solid coke. In general, feedstock is introduced to a fractionator, and the fractionator bottoms are removed and heated in a furnace which causes further thermal decomposition. The resulting solid coke is deposited progressively on the inner walls of a coke drum. In a typical delayed coker unit, a pair of coke drums are alternately filled and emptied with coker feed being pumped into one of the drums while the other drum is being emptied of coke and prepared for the next filling cycle.

The vapors associated with this process are vented at the top of the coke drum by an overhead vapor outlet nozzle. Overhead vapors from the drum being filled return to a fractionator where they are separated into product streams with the unwanted solids and liquids remaining in the bottom of the fractionator. Ideally, only vapors are taken out of the overhead vapor outlet nozzle because the delayed coking process becomes less efficient as more unwanted solids and liquids pass from the coke

drums into the fractionator. In the past, either the fractionator was shut down periodically and these unwanted solids and liquid materials removed or a continuous removal process at the fractionator was provided.

While filling coke drums, it has been observed that as feed is maximized through the coke drum and the height of coke in the coke drum is increased, it is common and undesirable to blow solid coke, liquid and foam out the top of the coke drum through the overhead vapor outlet nozzle. It has also been observed that as vapor leaves the coke drum at higher velocities, it becomes more entrained with solids and heavy hydrocarbon liquids which escape out the overhead vapor outlet nozzle and return to the fractionator.

Moreover, depending on the configuration of the delayed coking system and other parameters, the coke drum or drums may be operating under higher than atmospheric pressure, encouraging liquids and solids to be blown out of the vapor nozzle.

SUMMARY OF THE INVENTION

In view of the foregoing disadvantages inherent in known delayed coking units now present in the prior art, the present invention provides new and improved construction wherein the same can be utilized reliably. As such, the general purpose of the present invention, which will be described subsequently in greater detail, is to provide a new and improved delayed coking drum which has all the advantages of the prior art and none of the disadvantages.

To attain this, the present invention provides a deflector in the top coke drum interior. The deflector is placed below and spaced from the overhead vapor nozzle outlet so that solids and liquids traveling toward the nozzle are deflected back into the drum while vapors are allowed to pass out of the coke drum.

Before explaining at least one embodiment of the invention in detail, it is to be understood that the invention is not limited in this application to the details of construction and to the arrangements of the components set forth in the following description or illustrated in the drawings. The invention is capable of other embodiments and of being practiced and carried out in various ways. Also, it is to be understood that the phraseology and terminology employed herein are for the purpose of description and should not be regarded as limiting. As such, those skilled in the art will appreciate that the conception, upon which this disclosure is based, may readily be utilized as a basis for the designing of other structures, methods and systems for carrying out the several purposes of the present invention. It is important, therefore, that the claims be regarded as including such equivalent constructions insofar as they do not depart from the spirit and scope of the present invention.

It is therefore an object of the present invention to provide a new and improved delayed coking unit which provides some of the advantages of the prior art, while simultaneously overcoming some of the disadvantages normally associate therewith.

It is a further object of the present invention to provide a new and improved delayed coking unit which decreases the amount of solids and heavy hydrocarbon liquid drops escaping the coke drum and returning to the fractionator.

An even further object of the present invention is to provide a deflector improvement which is retrofittable to existing delayed coking units.

Still another object of the present invention is to provide a new and improved delayed coking unit which is more efficient and of a durable and reliable construction.

It is also a further object of the present invention to provide a new and improved delayed coking unit which maximizes input into a coke drum without blowing coke, liquid, and foam out the top of the coke drum.

These together with other objects of the invention, along with the various features of novelty which characterize the invention, are pointed out with particularity in the claims annexed to and forming a part of the disclosure. For a better understanding of the invention, its operating advantages and the specific objects attained by its uses, reference should be had to the accompanying drawings and descriptive matter in which there is illustrated preferred embodiments of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a schematic view of a delayed coking process to which the present invention may be applied.

Figure 2 is a side elevation, partly in cross section, showing details of a coke drum and deflector constructed in accordance with the present invention.

Figure 3 is a perspective view, partly in cross section, showing details of a coke drum and a conical deflector in accordance with an alternate embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Figure 1 shows a simplified, typical coker unit where coker feed from line 10 passes to furnace 12 where it is heated. The arrangement in Figure 1 utilizes a pair of coke drums although it will be appreciated that the present invention may be applied to a single drum or multiple drums. Coke drums 14 and 16 are alternately filled and emptied. When a drum has been filled with solid coke, access is provided to at least the bottom (and often the top) to remove the coke.

Overhead vapors from the coke drum being filled are returned via line 18 to coker fractionator 20. A recycle liquid such as coker gas oil or coker feedstock is feed into fractionator 20 via line 22. A wet gas overhead stream is removed from fractionator 20 via line 24, and intermediate liquid fractions are removed via lines 26 and 28. Unwanted solids and heavy hydrocarbon liquids 30 are removed from the bottom of fractionator 20 via line 32 and directed to the furnace. Various other modifications of the coking process may be made within the scope of the present invention.

Referring to the drawings in detail and to Figure 2 in particular, coke drum 14 includes a substantially cylindrical center portion and a top portion 34 with aperture 36 for access to interior of the coke drum 14. Overhead vapor outlet nozzle 38 is preferably removably attached to aperture 36 and leads to fractionator 20 via out line 18 (not seen in Figure 2). While dimensions may vary, in one preferred embodiment the diameter of the outlet nozzle may range from between approximately 24 to 30 inches (61 to 76 cm).

Figure 2 is partially cut away for clarity. The invention includes the addition of deflector 40 placed generally below and spaced from aperture 36 in the coke drum 14 and suspended from overhead vapor outlet nozzle 38. Deflector 40 is generally removably attached by an attachment mechanism 42 to overhead vapor outlet nozzle 38. In one embodiment, deflector 40 is preferably

suspended 1 (one) to 10 (ten) feet below overhead outlet vapor nozzle 38. Examples of attachment means are brackets, bolts, wires, hooks, screws, or the like. Accordingly, after the vapor outlet nozzle hardware is disassembled, the deflector could be pulled out.

In one embodiment, deflector 40 is preferably a circular plate made from metal or other suitable material with a sufficient diameter to generally cover aperture 36 but also fit through aperture 36 when overhead vapor outlet nozzle 38 is removed from coke drum 14. Accordingly, the diameter of the plate will be slightly less than the diameter of the aperture.

Another preferred embodiment of deflector 40 is a generally conically shaped deflector 44 as shown in Figure 3 where apex tip 46 of the cone points toward overhead vapor outlet nozzle 36. The center point of the aperture is generally aligned with the apex tip.

In a further embodiment (not shown), the deflector might take the form of a pair of inclined panels joined together.

In each embodiment, escaping vapors are forced to take a circuitous route. During operation, feed heated in the furnace is delivered to the drum and thermally decomposes. Vapors in the drum will rise toward the aperture. Liquid droplets and solid particles will impinge on the deflector and drop back into the drum. Meanwhile, vapors will pass around the deflector and exit through the outlet.

It will be appreciated that the present invention may be easily retrofitted to existing coke drums. In most cases, the deflector may be suspended from the overhead vapor outlet nozzle by fasteners such as bolts.

Since it has been observed that at higher velocities of the vapor leaving the drum, there is more entrained solids and heavy hydrocarbon liquids that escape, the present invention will produce a higher quality product or permit running at higher velocity.

Whereas, the present invention has been described in relation to the drawings attached hereto, it should be understood that other and further modifications, apart from those shown or suggested herein, may be made within the spirit and scope of this invention. Thus, it will be appreciated that as a result of the present invention, a new and improved delayed coking unit is provided. Changes may be made in the combinations, operations, and arrangements of the various parts and elements described herein without departing from the spirit and scope of the invention as defined in the following claims.

Accordingly, the present invention provides a coke drum for a delayed coking unit wherein said coke drum comprises:

a substantially closed interior;

a top portion of said drum having an aperture therethrough;

an overhead vapor outlet nozzle connected to said aperture; and

a deflector for deflecting solids and heavy hydrocarbon liquid from exiting said interior of said coke drum through said aperture.